IN THE SPECIFICATION:

Please substitute the paragraph starting at page 3, line 4 and ending at page 3, line 18 with the following replacement paragraph. A marked-up copy of this paragraph, showing the changes made thereto, is attached.

--In the present invention, detection means is used. The detection means is capable of detecting the image printed on the printing medium by moving along with the printing head relative to the printing medium. The printing head is controlled according to the detection result of the detection means. To be more concrete, the driving of the plurality of printing elements in the printing head is controlled. Actual printing result information by the plurality of printing elements in the printing head is fed back, thereby these printing elements are controlled according to the actual situation. As a result, the image can be printed stably and with high accuracy by avoiding effects of a dimensional error printing characteristics specific to the printing head and a mounting error of the printing head.--

Please substitute the paragraph starting at page 3, line 19 and ending at page 4, line 1 with the following replacement paragraph. A marked-up copy of this paragraph, showing the changes made thereto, is attached.

--Further, by providing the detection means and replaceably mounting the printing head to the carriage of a serial-type printing apparatus, control contents for the printing head can be corrected. Thereby, particularly, the effects of the printing characteristics of each of the replaceable printing heads and mounting error due to attachment and detachment of the printing head are avoided. As a result, stable printing can be achieved without variation of printing characteristics specific to the printing head.--

Please substitute the paragraph starting at page 4, line 20 and ending at page 4, line 25 with the following replacement paragraph. A marked-up copy of this paragraph, showing the changes made thereto, is attached.

--Further, by the detection means provided commonly for the plurality of printing heads, an image printed by each of the plurality of printing heads can be detected. Thereby, the actual situations of the plurality of printing heads are efficiently detected, and the detection results can be utilized in controlling these printing heads.--

Please substitute the paragraph starting at page 4, line 26 and ending at page 5, line 5 with the following replacement paragraph. A marked-up copy of this paragraph, showing the changes made thereto, is attached.

--Yet further, as the detection means, a light source for emitting light and a photoelectric conversion element for receiving reflected light from the printing medium

A4 end

can be used. Yet further, as the printing head, it is possible to use an ink-jet printing head provided with a plurality of ink ejectable printing elements.--

Please substitute the paragraph starting at page 6, line 3 and ending at page 6, line 9 with the following replacement paragraph. A marked-up copy of this paragraph, showing the changes made thereto, is attached.

--DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A5

In the following, embodiments of the present invention will be described with reference to the drawings. The present embodiment is an application example of an ink-jet printing apparatus and ink-jet printing method for forming an image on a printing medium.--

Please substitute the paragraph starting at page 6, line 10 and ending at page 7, line 19 with the following replacement paragraph. A marked-up copy of this paragraph, showing the changes made thereto, is attached.

--Fig. 1 is a perspective diagram of an ink-jet printing apparatus 1, which represents features of the present invention. In Fig. 1, numeral 2 denotes an ink-jet printing head provided with a plurality of nozzles constituting a plurality of printing elements. The respective nozzles are provided so as to eject an ink in the downward direction in the figure. As the ink ejection method, any of a method using a piezoelectric element and a

A6 Contd

A6 end

bubble-jet method for ejecting ink by a bubble in the ink generated by thermal energy and the like may be employed. In the case of the bubble-jet method, by an electrothermal converter provided in the nozzle communicating with the ink ejection opening, thermal energy utilized as ink ejection energy is generated. That is, in association with bubble generation of ink by the thermal energy, an ink droplet can be ejected from the ink ejection opening. Numeral 3 is a carriage for mounting the printing head 2 and which carriage is connected to a timing belt 9. The timing belt 9 is mounted between a drive pulley 8 and a guide pulley (not shown). By rotating the drive pulley 8 by a carriage motor 7, the carriage 3 is reciprocally moved in the primary scanning direction of arrow A through the timing belt 9. The carriage 3, by being slidingly moved on a slide shaft 4 and a slide plate 5 fixed between chassis 6a and 6b, with a regulated posture, is reciprocally moved to a position opposite to a paper 30 as a printing medium. The paper 30 is stacked in a paper feed unit 10, and, as necessary, is fed onto a platen by a paper feed roller (not shown), and a portion thereof on the platen is formed with an image by the printing head 2. That is, by repeating a printing operation and a feeding operation, images are successively printed on the paper 30. In the printing operation, the printing head 2 ejects an ink droplet while moving in the primary scanning direction. In the feeding operation, the paper 30 is fed a predetermined amount in a secondary scanning direction by arrow B by a transportation roller 11 and a paper discharge roller 13.--

Please substitute the paragraph starting at page 7, line 20 and ending at page 8, line 13 with the following replacement paragraph. A marked-up copy of this paragraph, showing the changes made thereto, is attached.

--To the transportation roller 11, rotation of the transportation motor (not shown) appropriately reduced by a gear train 14 is transmitted. Numeral 12 is a pinch roller which is disposed at a position pressing against the transportation roller 11. The paper 30 is pressed between the transportation roller 11 and the pinch roller 12, so that the transportation force is surely transmitted. A transmission roller 34 rotates the paper discharge roller 13 slightly faster than the transportation roller 11. An area between the transportation roller 11 and the paper discharge roller 13 is a printing area, which is set as a larger area than a maximum printing width by all nozzles of the printing head 2, thereby in the printing area, flatness of the paper 30 is secured. The right side position in Fig. 1 is a stand-by position of the printing head 2, at which a recovery operation for recovering the ink ejection condition of the nozzle is performed. Numeral 32 is a printing condition detector as detection means mounted on the carriage 3, which, as will be described later, is provided with a plurality of detection elements.--

Please substitute the paragraph starting at page 8, line 14 and ending at page 8, line 16 with the following replacement paragraph. A marked-up copy of this paragraph, showing the changes made thereto, is attached.

--Fig. 2 is an enlarged perspective diagram showing a portion for explaining the construction of the printing condition detector 32.--

Please substitute the paragraph starting at page 8, line 17 and ending at page 9, line 12 with the following replacement paragraph. A marked-up copy of this paragraph, showing the changes made thereto, is attached.

--In Fig. 2, numeral 26 is a light source unit for irradiating light to an image printing part on the paper 30. Reflected light from the image printing part on the paper 30 is focused by a focusing lens 27 disposed vertically above the paper 30, on a detection element (not shown) of a reading sensor 29. The reading sensor 29 and the focusing lens 27 are integrated by a lens holder 28, which is incorporated with the carriage 3 after position adjusting. The reading sensor 29 is mounted to the lens holder 28 through a flexible cable 31, and transmits a read signal of reflected light from the image printing part on the paper 30 to an image processing circuit 30 on the flexible cable 31. The image processing circuit 30 transmits a processing result of the read signal through a flexible cable 24 to a processing circuit of a printing apparatus main body. Numeral 19 is a bearing in sliding contact with the slide shaft 4, and 26 is a pressing member for pressing the light source unit 25 to a predetermined position. Further, numerals 20 and 23 are slide members slidably guided by the apparatus main body side guide member including the slide plate 5. Still further, numeral 18 is a sensor for detecting a moving position of the carriage 3.--

Please substitute the paragraph starting at page 9, line 13 and ending at page 9, line 22 with the following replacement paragraph. A marked-up copy of this paragraph, showing the changes made thereto, is attached.

--The printing head 2 can be mounted between a contact portion 3a and a head holder 21 of the carriage 3. By rotation of a lever 22, a contact portion 2a (see Fig. 1) of the printing head 2 is pressed against the contact portion 3a of the carriage 3 so that these components electrically contact each other. The printing signal is inputted from the flexible cable 24 to the printing head 2 through the contact portion 3a and the contact portion 2a, and the printing head 2 ejects ink droplets according to the printing signal.--

A10

Please substitute the paragraph starting at page 9, line 23 and ending at page 10, line 27 with the following replacement paragraph. A marked-up copy of this paragraph, showing the changes made thereto, is attached.

--Fig. 3A is a diagram for explaining the relationship among detection devices 50a and 50b of the printing condition detector 32 fixed in a predetermined position on the carriage 3 and ink ejection openings 40a to 40l of the printing head 2 replaceably mounted on the carriage 3. Fig. 3A is a diagram of the detection devices 50a and 50b and the ink ejection openings 40a to 40l when viewed from vertically above the surface of the paper 30. In the case of the present embodiment, when the carriage 3 scans in the direction of the arrow in the figure, the printing head 2 performs the printing operation. The array of

A11 Cont'd

A11 end

the ink ejection openings 40a to 40l should essentially be along a design center C perpendicularly crossing with the primary scanning direction of the arrow in the figure. However, because of dimensional error of the printing head 2 and a mounting error of the printing head 2 to the carriage 3, the array of the ink ejection openings 40a to 40l (nozzle array) inclines by an angle A relative to the design center C. Further, the printing condition detector 32 of the present embodiment has two detection elements 50a and 50b, which are mounted on predetermined positions of the carriage 3 after position adjusting so that they are arranged in a direction perpendicular to the primary scanning direction of the arrow in the figure, that is, positioned in the vertical direction in Fig. 3A. The array of the detection elements 50a and 50b in the vertical direction in Fig. 3A is set to be parallel to the design center C and to be in a position away from the center C by a predetermined distance M in the primary scanning direction. Further, the detection elements 50a and 50b are positioned away from each other by the same width as a maximum printing width W per scan of the printing head 2.

Please substitute the paragraph starting at page 11, line 7 and ending at page 12, line 6 with the following replacement paragraph. A marked-up copy of this paragraph, showing the changes made thereto, is attached.

A12 cont'd

Fig. 3B is a diagram for explaining printing dots (printing pixels) 41a to 41l formed by the printing head 2 mounted in the condition that the array of the ink ejection openings 40a to 40l is inclined relative to the direction perpendicularly crossing

A12 end

with the scanning direction of the printing head 2 as shown in Fig. 3A. In Fig. 3B, one ink droplet was ejected per scan from each of the ink ejection openings 40a to 40l. Printing dots 41a to 41l are printing dots formed by ink droplets ejected from the respective ink ejection openings 40a to 40l. Inclination of the array of the printing dots 41a to 41l corresponds to inclination of the ink ejection openings 40a to 40l. Symbol P in Fig. 3B represents a deviation amount between printing dots 41a and 41l in the primary scanning direction, that is, a deviation amount between the ink ejection openings 40a and 40l, which corresponds to a distance (L-S). During scanning of the carriage 3, the detection elements 50a and 50b immediately detect optically the printing dots 41a and 41l printed by the printing head 2. When a difference in detection time of these printing dots 41a and 41l is greater than a printing time for 1 dot as a minimum printing resolution, print timing of the image is adjusted. That is, as shown in Fig. 3B, a difference in detection time of the printing dots 41a and 41l is greater than 1 dot printing time as the minimum printing resolution, and it is judged that adjustment of ink droplet ejection timing is necessary.

Please substitute the paragraph starting at page 12, line 7 and ending at page 12, line 21 with the following replacement paragraph. A marked-up copy of this paragraph, showing the changes made thereto, is attached.

A13 cont'd

In the present embodiment, among ink ejection openings at one end side and the other end side of the ink ejection opening array (nozzle array), one of a greater deviation amount from the center C (in the present embodiment, the ink ejection opening

A13 end

40l side) is determined as an adjustment subject side. Ink droplet ejection timing of the ink ejection openings (in the present embodiment, ink ejection openings 40i, 40j, 40k, and 40l) out of the tolerable deviation range of 1 dot as the minimum printing resolution is shifted by 1 dot printing time. The ink ejection openings out of the tolerable deviation range of 1 dot can be selected from the relation of the distance P determined from the detection time difference of the detection elements 50a and 50b, the printing width W, and the arrangement position of the ink ejection openings.--

Please substitute the paragraph starting at page 13, line 2 and ending at page 13, line 25 with the following replacement paragraph. A marked-up copy of this paragraph, showing the changes made thereto, is attached.

A14 Contd

--Further, a control system of the printing apparatus according to the present invention can be a system configuration including a CPU, ROM and RAM. In this case, the CPU executes a processing for the above-described ejection timing adjustment according to a program stored in the ROM. For example, the CPU first determines whether or not a difference in detection time of printing dots 41a and 411 by the detection elements 50a and 50b is greater than the time for 1 dot as the minimum printing resolution. When the detection time is greater than 1 dot printing time, it is determined that print timing adjustment is necessary, and an ink ejection opening to be subjected to ejection timing adjustment is selected as described above. In the selection, a data table can be used. Then, a control signal is sent to a control circuit of the printing head 2 so that ejection

A14 end

timing of an ink droplet from the selected ink ejection opening is shifted. The RAM can be used as a work area for the processing of the CPU. Further, under the control of the CPU, through a driver, the printing head 2, the carriage motor 7, and the transportation motor are controlled. Still further, it is also possible that under the control of the CPU, printing data is received from external devices such as a host apparatus, and an image is printed according to the printing data.--

Please substitute the paragraph starting at page 13, line 27 and ending at page 14, line 9 with the following replacement paragraph. A marked-up copy of this paragraph, showing the changes made thereto, is attached.

A15

--In the above-described embodiment, a total of two detection elements are provided at positions corresponding to the ink ejection openings at both ends of the nozzle array. However, alternatively, detection elements may be provided so as to oppose all the ink ejection openings, in this case, the deviation amount can be corrected independently for every ink ejection opening. Further, detection elements may be provided so that each one corresponds to every group of a plurality of ink ejection openings.--

Please substitute the paragraph starting at page 15, line 5 and ending at page 15, line 9 with the following replacement paragraph. A marked-up copy of this paragraph, showing the changes made thereto, is attached.

--Yet further, the present invention can also be applied to printing heads provided with various printing elements such as thermal transfer type heads and the like, in addition to the printing head provided with the ink-jet printing element.--

A16

Please substitute the paragraph starting at page 15, line 10 and ending at page 15, line 17 with the following replacement paragraph. A marked-up copy of this paragraph, showing the changes made thereto, is attached.

--The present invention has been described in detail with respect to preferred embodiments, and it will now be apparent from the foregoing to those skilled in the art that changes and modifications may be made without departing from the invention in its broader aspects, and it is the intention, therefore, that the appended claims cover all such changes and modifications as fall within the true spirit of the invention.--

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IN THE ABSTRACT:

Please replace the Abstract of the Disclosure with the following:

--ABSTRACT OF THE DISCLOSURE

A18 cont'd

The present invention is to provide a printing apparatus and printing method capable of stably printing an image with high accuracy by avoiding effects of a dimensional error and printing characteristics specific to a printing head and a mounting error of the